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ASSOCIATION.

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PROCEEDINGS OF THE PHILADELPHIA FOUNDRYMEN'S ASSOCIATION.

The regular monthly meeting of the Philadelphia Foundrymen's Association was held at the Manufacturers' Club, Philadelphia, on Wednesday, June 7th, with a good attendance of members. The president, P. D. Wanner, occupied the chair.

The Executive Committee presented a report in which reference was made to the recent convention of the American Foundrymen's Association at Pittsburg and the work accomplished thereat. In regard to the present condition of the foundry trade, the report stated "the foundry industry has never been so prosperous since the formation of the various foundrymen's associations in this country as it is to-day, and there has never been a better feeling in existence among foundrymen. It is our thought that the associations throughout the country have at least brought about the better feeling existing among foundrymen one to another, and while they have not to any extent made prices for castings or for labor, they have helped those who do not know how to get at the cost of castings, and thus exerted some influence toward the maintenance of prices."

Letters received from sections in the State of New York and in the Northwest were read, in which it was stated that under-

standings had been arrived at among the foundrymen of the districts looking toward the establishment and maintenance of prices advantageous to the foundry trade.

Wm. Hanson, Pennsylvania Iron Works Company, Philadelphia, was elected to membership in the association.

The paper of the evening was by A. B. Farquhar, of the A. B. Farquhar Company, York, Pa., on "Trade, Trusts and Tariffs."

TRADE, TRUSTS AND TARIFFS.

The theme chosen for my address this evening affords abundant room for discussion. We are all interested in trade, and in trusts and tariffs as they affect our business. Currency and revenue legislation do not properly belong to party politics—ought not to be treated as if they did, and I need hardly say I shall not so treat them. I belong to neither party, but find much to criticise in both; I highly value my independence, and to fellow-independents address myself. Since the prosperity of the foundry business depends upon general trade conditions we are interested in whatever affects production universally. But we live in the Iron Age, and as successors to Tubal Cain we are especially concerned with iron.

The manufacture of iron is of remote antiquity. It is spoken of in several places in the Pentateuch, also in Job and the Prophecies. Old English translations speak of "steel' also, but erroneously; their Hebrew word really means "brass." Homer, Hesoid and Aristotle have a good deal to say of iron. Founding or casting iron is a comparatively recent invention. It is true that an iron statue has been discovered in Egypt which was probably manufactured at least three thousand five hundred years ago, and a recently found statue of Hercules must antedate the Christian era seven hundred years, but the metal is malleable and believed to have been forged. The first castings that we have record of were made toward the close of the fifteenth century, and it was not until well on in the eighteenth that coke was first used for casting iron, anthracite being introduced about 1820. Iron must have been made in immense quantities by the Romans.

Twenty blast furnaces in Germany were supplied for two hundred years from cinders left by the Roman iron works, over which a great forest had grown, but these furnaces were very primitive and a ton per day was considered a very good yield. Indeed, from the earliest records three thousand years ago down to the seventeenth century there was but slight improvement made in the mode of converting iron from the ore, and the same methods are yet purusued in India, Madagascar and other Eastern nations. The style of furnace now used was invented about the year 1825.

The progress in shaping wrought or malleable iron was about as slow. It was not till the year 1783 that grooved rolls were invented. Up to that date iron bars were forged, and according to the best obtainable data, until the seventeenth century the total yearly amount of iron manufactured in the world did not equal the product of one of our improved furnaces to-day. But it is of the present situation I propose to speak now.

Official statistics with regard to the foundry industry are disappointingly scarce. In the census reports "foundries and machine shops" appear together. The proportion of iron used in foundry castings is about one-fifth in Germany; though not ascertained for other countries, we may accept the same fraction as holding approximately true everywhere. Applying it to our own production, we infer that this county so uses over 2,000,000 tons of pig iron annually. The product of our foundries has hitherto been consumed within the country, our export being, until the last year or two, insignificant. This export is mainly of pipe, but also includes builders' hardware and malleables.

The condition of productive business is so much of the time unsatisfactory, and the difficulty of finding a market so serious for the producer, that we warmly welcome a season of brisker demand, freer payments, orders crowding upon us and better opportunities for the disposition of our wares, and we all rejoice in the good times of the year 1899. It is only because I would have this year the forerunner of a series equally bright rather than a gloomy season of reaction that I now ask attention to some of the darker lines in the picture.

We have had good times before—in 1872, for instance, and 1879 to 1881, and 1891 to 1893, and we too well remember the dreary depressions by which they were followed. If disasters like those are now to be avoided, it can only be by taking careful account of every feature in the present situation from which a warning can be drawn. Our trade is prosperous as a whole. The marked improvement began in 1897, when we broke all previous records in exports of domestic merchandise, shipping ten hundred and eighty million dollars' worth. In 1898 our exports exceeded twelve hundred and thirty-three millions, those of manufactures forming one-fourth of this total, or three hundred and eight million dollars' worth—10 per cent. above the highest previous figure. All iron and steel wares shared this increase. By this time our exports exceed $70,000,000 worth annually, more than five times the value of our imports; 20 years ago the figures were almost exactly reversed, the exports of iron and steel manufacturers amounting to barely one-fifth of the imports. The value of agricultural machinery exported, for instance, rose from $5,303,000 in 1897 to $9,073,000 in 1898, or about 70 per cent. Exports of plows nearly doubled from 1897 to 1898, while those of reapers and mowers more than doubled.

But there is no call to weary you with details, the general advance along the line in both domestic and foreign trade being too clearly marked.

Our production of pig iron, for no previous year so high as 10,000,000 tons, last year reached 11,700,000 tons, exceeding the British output by 50 per cent., and nearly equaling the whole world outside of Great Britain. This increase in production was accompanied by decidedly sharper demand and continually rising prices. The present year has brought nothing thus far to discourage, everything to stimulate, the industry. If production continues at present rates, a total output exceeding 13,000,000 tons may be realized; prices are still booming, the increase since last summer being 55 per cent. on pig and 70 to 100 per cent. on pipe, rolled iron and steel; altogether the opportunities afforded to iron production by the present situation are simply unequaled.

The manner in which all this prosperity is distributed is not quite as satisfactory. The material interests of the community as a whole, to say nothing of abstract justice, are intimately concerned in the question of distribution.

THE PROBLEM OF TRUSTS.

What is known as the problem of trusts is in its essence whether the best opportunities shall fall to few or many; and it is made more difficult by the amount that can be said both for and against the organizations called by that name. The movement against trusts has been long and earnestly pushed by intelligent people, and yet so far from having made any progress, it has never lacked so much of success as it lacks to-day. Trusts have never before held their ground so triumphantly or made so many threatening invasions of new territory. The combat against them is growing more and more difficult year by year, indicating that we have not found the proper method of attack or failed to discover their source of power. If ever curbed, it must be at once, or nothing is left for us but submission.

But before we can safely enter the lists against an enemy it is well to know something about him; in what ways he may be dangerous and in what ways harmless or helpful. With no more knowledge of trusts than is displayed by many who talk about them, fighting would be only striking out in the dark. The fact is that, technically speaking, there are now few if any trusts in the United States. That form of industrial combination was once prevalent, but it has substantially disappeared. We used to have trusts—that is to say, associations or corporations intrusting their management to a board of trustees that carried on operations and divided profits. But these have given place to consolidated corporations, smaller concerns passing into larger, without assuming a new character or modifying their corporate functions in any way. This change, first invoked by hostile legislation, admirably suited the purpose of the trusts themselves; their consolidation grew more complete, and closer unity gave greater power, while the desirability of avoiding difficulties by abandoning the trust form, while holding fast to every advantage

it afforded, was quite evident. In fact, while laws to permit trusts may be quite constitutional, it is difficult to see how a law to prevent corporations from consolidating could stand. It would be too much like an attack on property rights, which necessarily include the right to sell, and hence to buy out other people. Whether we have trusts to deal with, however, or giant corporations under another name, need not concern us; we are considering the thing rather than the designation. But it is interesting to observe how superficial the change that enables these colossal industrial combinations to escape all the trouble that legislation has prepared for them; it thus appears how ineffectual any anti-trust law" must ever be to contend against them.

THE ADVANTAGES OF CONSOLIDATIONS.

Furthermore, in order to understand the real nature of these combinations, it is essential to distinguish the good from the evil in them. Our most dangerous enemies have their better side—"there is a soul of goodness in things evil." Trust is a Christian virtue; only those who have learned how to trust will combine. In the first place, there is sometimes reason for the claim that "trusts make things cheaper." But the claim is pushed too far when we are asked to excuse the manifold iniquities of the Standard Oil because the price of refined petroleum has fallen. We must remember that when petroleum has once been found, its output cannot be repressed as that of other products; and that to store large quantities of it, and so keep it out of market, is exceptionally difficult and risky. The progress of invention has cheapened mineral oil as it has many other things; raw cotton, in fact, whose production has been controlled by no combination, has fallen quite as remarkably. But consolidation of capital reduces costs, can reduce prices, and sometimes does. A more perfect organization gives opportunity for better economic methods in purchasing, in manufacturing, transporting and marketing, and in mastering thousands of petty but necessary details. An important economy comes from specializing business among different establishments. Another results from avoiding the many wastes of competition; and this usually de-

termines whether there shall be a trust or not. In such a business as sewing machines or stoves, for instance, where the cost of selling is 30 per cent. of the cost of manufacture, or more, combination is highly economical. But in the general foundry business, employing no traveling salesmen and comparatively little machinery, there could be no such advantage, and therefore this business has little to gain by forming a trust, and much to suffer if our supplies are cornered. Combination does tend, as a rule, to make the market less speculative. Our industrial trusts may not give us the best form in which consolidation could be consolidated, but that there will be consolidation in some form follows necessarily from the law of evolution. Indeed, the progressive march of industrial combination is something impossible to withstand. Washington Gladden, a well-known writer on social questions, truly says:

Concentration in all the great industries is the word of the hour. We can no more go back to the old economic regime than we can return to the stage coach and the hand loom. The only question is, who shall control these vast enterprises? Is the capital of the country all to be gathered into the hands of a few men and administered by them according to their pleasure? Doubtless, if we could be sure that the managers of these gigantic industries would all be sagacious and unselfish men, consulting the public interest in all their actions, this might be a desirable arrangement. But experience does not encourage us to look for such virtues in those who possess such enormous power.

THE EVILS OF TRUSTS.

The vices pertaining to men in industrial combinations are perhaps not greater than those of imperfect human nature in separate action, except in so far as their association gives them added strength. Yet those vices must not be slighted. That repression of manly development and character which comes of resigning our independence and becoming merely part of a machine is by no means least among them. The cheapening of commodities above spoken of generally results from forces beyond the control of the trusts; while the resistance of cheapening,

through cutting down production and thus promoting scarcity, is altogether voluntary with them. While they are curtailing their output to run up the price, they do not consider whom they thus deprive of employment—steady prices are more important to them than steady work. And while illiberal toward the public and harsh toward the working class, they are utterly merciless toward all rivals. Their mischief has grown with their power, by closer consolidation; the trusts were mild and innocuous by comparison with the combinations that have supplanted them. One of the greatest evils shown in connection with them is in their overcapitalization of stock. When we learn that in one month, in one State, corporations of a total capital of over a thousand millions were chartered—as was the case in New Jersey last March; when we read the list of such organizations, all of recent origin, with nominal capital of six thousand millions, and know that they probably represent a true value of less than one thousand millions, we may be assured either that the investors are to be robbed, or that they will profit by plundering the public. Many of these joint stock corporations are formed with a view to selling the stock, and thus coining a huge profit on water. Sometimes projectors succeed in this by mere trickery, but more often there is some concealed advantage they enjoy which goes to explain their success. No share in an industrial enterprise could sell at very much above its actual cost unless there was some kind of monopoly behind it—based on land possession, or a patent, or a special legislated privilege, or unrestricted possession of its field assured by force. Serious as this is, the consequences, to which our neglect to cure it may lead are no less serious to contemplate. Let me quote again from that clear-sighted writer, Washington Gladden:

"Such a gigantic attempt to bind burdens upon the whole community of consumers must provoke a violent reaction. These thousand millions of watered stock are simply a legalized demand upon the people for contributions of their substance to those who have given them nothing in exchange. The feudal lords of the olden time made no such unjust demand. It will not be endured.

And there is terrible danger that these injustices will be swept away by a whirlwind of popular wrath."

Beyond question these evils, belonging to or associated with combined capital, ought to be cured if curable. One way to meet them is by proclamation and denunciation. It is confidently promised that the next Republican platform will contain a "ringing plank against trusts." That the Democratic opposition will equal or outdo that example in pronunciamento is accepted as altogether probable. Thus will the air be filled with claims and counter claims, in the midst of which the trusts themselves will suffer not a particle. They thrive on opposition like that. I have already given reasons for believing that anti-trust laws of the usual general kind are little more effective than platform proclamations. Nor, so long as laws are of this character, is there much hope that individual States can operate them more successfully than the general Government. The efforts of a few States, particularly Missouri, are certainly not encouraging. Laws impairing the obligation of contracts would do more harm than good, even if they were not glaringly unconstitutional. Everything that has been heretofore done in this line has not only not helped, but positively hurt us, by driving producers from trusts (properly speaking) into the closer combinations that are so much more dangerous. Law can do something for the public even in this case if rightly contrived; but law of the kind contemplated in platforms hitherto enacted—a dead letter *ab initio* because totally unenforceable—is the very food that the trusts thrive upon. It would be unfair to pass from the topic of humbug remedies that only aggravate the complaint, and make no mention of that most dangerous humbug of the lot, the one which pretends to subdue all trusts by striking a blow at a bogie called "the money trust"—that is to say, by a wholesale violation of the obligation of contracts. The most effective service that can be done for these aggregations of capital is by demanding some cure that will be worse than they are, and so giving them a factitious respectability by contrast; and just that service is done them when it is proposed to fight them with free silver.

GOVERNMENT CONTROL.

Among the proposed remedies for the trust evil is that of putting more power over the management of industries into the hands of Government—giving it the same control over other enterprises that it now has over the postal service. Natural monopolies, we are told by more than one thoughtful writer, belong to the whole people and should never be allowed to pass into the hands of a few. Following this principle, the monopoly advantage now enjoyed by private associations of capitalists would remain to the people and be administered by their agents for their benefit. The plan would be excellent, if it could be made to work as its proposers would have it work. But can it? The difficulty is this: What those writers prove is that this business is suitable to governments as they ought to be, while our practical problem deals with governments as they exist. Regulaiton of great industrial enterprises might properly enough be committed to a government administered with strict integrity and economy by capable and broad-minded business men; if we handed them over to the rulers we now choose we must expect to see enterprises undertaken as our river and harbor improvements, public buildings and post route extensions are now undertaken—too often not because they will repay their cost, not because the public interest calls for them, but because some politician with a strong pull is able to force them through. We must expect to see the choice of men to conduct these enterprises made on similar grounds. The idea can be regarded as practicable only when business principles shall have taken a firmer hold upon the conduct of our Government than they yet have; when business methods shall govern public improvements and shall not be forgotten even in the allotment of pensions; when the business rule of assigning places according to fitness is as firmly fixed in our republican system of government, and when the demands of what is known as "civil service reform" shall be accepted as an unquestioned matter of course. Government of, by and for the people is a glorious thing, as we all confess, but it needs to pass through a further probation before it can be trusted with direct charge of industries.

TAXATION.

But there are a good many things that the Government can do for us indirectly, and one of them is to break up the condition under which the evils of which we complain have their rankest growth—that of secrecy. Legislation can be used to let in the light; to show truth where now is confusion. It may attach conditions to the corporation which it creates; among those that have been recommended are that the books of stock companies shall be open to inspection, and that no such company shall be admitted to corporate privileges on its own valuation of its stock —official valuation being made an indispensable condition. Publicity would be one remedy for the pernicious evil of watered capital; another remedy, not insurmountably difficult to apply, would be taxation. A tax based on nominal capital might easily have some effect to prevent that capital from being exaggerated. It would have a greater effect in that way if the amount of capital actually paid in were deducted from the assessment, so that the tax burden might be borne by the water alone. Graduated taxation has also been suggested; the effect of this would be to discourage consolidation in very large aggregations, since the same money invested in one capital stock would be liable to a higher tax than if divided among many. I shall not undertake to say which of these proposed plans would be best. Taxation is a complicated matter, and a theoretically bad tax that can be collected certainly and equally is to be preferred to a theoretically better tax that cannot be collected. In considering what would practically prove the best way to tax corporations, we must have at command all human experience of taxation, and at the same time not leave out of view the hundreds of expedients by which the corporations may creep out of paying.

Would it not be possible, it may now be asked, to disarm the trusts by taking off taxes that help to create the monopoly on which their inordinate profits depend, and so control them more effectually than by imposing taxes upon them? The tax they might perhaps evade, but there is no dodging a removal of the tax now levied upon the people for the benefit of the trusts.

Monopoly, brought about by nature, or favoritism, or force, is, let me repeat, the condition which the trust most earnestly seeks to secure, and the enjoyment of which gives it most power over the community. Deprive it of monopoly and we disarm it—there is little use of trying to fight it any other way. And yet the law, on which we depend for aid, seems in certain of its provisions as though deliberately calculated to give trusts every advantage. It imposes taxes on commodities entering the country from outside, and thus renders it easy for any organization that may acquire control over the supply of those commodities within the country to enjoy a substantial monopoly, increase the profits of production and rate its capital stock at an inflated valuation. The monopoly partly assured by favoring tax laws, is rendered complete by force—rivals being suppressed by the combination through what are virtually acts of war. Thus comes about the aliance of tariffs and trusts, contemplated in the title to this address. This alliance it is that is driving so many people, from different parts of the country and from the ranks of different political parties, to advocate tariff modification as the proper cure for the trust evil.

TRUSTS AND THE TARIFF.

This is no suitable arena for partisan contentions, and it is a wise rule that excludes questions of politics from discussion here. But though the tariff issue is one on which elections have often turned heretofore, and may turn hereafter, it is happily not in politics as we are considering it. In the inner circle of Colonel Bryan's adherents it has been accepted as party orthodoxy to leave the tariff alone and strain every nerve to overcome "the money power;" while, on the other hand, some of the most earnest appeals for reduction of duties on articles controlled by trusts have come from stern, unbending Republicans. Though advocates of protective duties on other products of industry, they argue, not without reason, that the application of such duties to increase the cost of trust controlled products must tend to discredit protective duties altogether. We may therefore consider this proposed remedy without fear of bringing it into politics.

So considering it, we must see at a glance that there are a great many products of manufacturing industries in this country which, whatever may have been their need of protection heretofore, most certainly do not need it to-day. In the ten months ending with April last the country exported $276,000,000 worth of manufactures, nearly 18 per cent. more than the corresponding ten months of 1897 and 1898. This amount, considerably exceeding that of our imports of manufactured goods for the same period, covering a wide range of products, conclusively proves that we have nothing to fear from foreign manufactures. Yet a duty is still demanded on these very products, and why? Not for revenue, because the Government gets no revenue from such duties, but to enable the combinations that monopolize their production to exact higher prices in this country than they can obtain abroad, and for no other reason. The Sugar Trust, with its rebates to encourage exportation and its high protective duty to keep up the price of its product within the country, thus favored by the law in two directions; the steel rail combine, which sends its product to all quarters of the globe (one mill recently shipping 70,000 tons of rails for the North China Railway) and puts them down at the very doors of the British shops, while at the same time a Boston company finds it cheaper to get rails from England and pay the duty than to buy at the terms allowed at home; the tin plate monopoly, special and particular favorite of protective legislation, now empowered to exact whatever prices it thinks the public able to bear; these and many other associations, all profiting handsomely by legislative favoritism, tempt us to appeal to the law not to lay its hand upon them in any way directly, but only to lift from us the hand with which it holds us down in order to give the monopolies advantage.

You need not accept my testimony unsupported. The officers of a prominent manufacturing company in Wisconsin, convinced that the high duties of our present tariff law were provoking retaliation on the part of more than one country of continental Europe, where it would be advantageous to us to sell machinery, sent out a circular letter a few weeks ago to manufacturers

throughout the United States. In this circular the opinion was plainly expressed that this country had passed the need of protection in machine construction, and that the tariff thereon ought to be greatly lowered or abolished altogether; the views of correspondents on the subjects being also solicited. By the kind permission of the authors of the circular, I have been enabled to read a number of the replies. The great majority of the writers, representing well known houses from Pennsylvania westward, agreed that the policy of reducing duties and so warding off retaliation from abroad was now preferable. These writers held the point of view in the manufacturer, seeking to build up an export trade, and their testimony goes to prove that machinery in this country needs no tariff protection. Nor do I see how any manufacturer, desiring only a fair show in home markets and not an opportunity for extortion, can fail to agree with them. This country has grown great in manufacturing because it can make iron cheaper than any other if it chooses. It is the great magazine of essential supplies—timber, limestone, coal and metals, as well as exhaustless stores of food at easy command. Moreover, it is peopled by an ingenious and energetic race—the very pick of the best stock in the Old World. To teach that such a people, in such a land, could not prosper and push ahead without tariff duties has been proved flat absurdity.

Since we are so loudly told by the trusts and combines and their organs and dependents that it was the very mild and modest curtailment of their monopoly privileges in the tariff of 1894 that caused the business depression of 1893, it is worth while to stop for one minute to inquire how that depression really came about. The matter is well enough understood, of course, by those who remember the conditions of the time, and therefore knew that tariffs had no more to do with our trouble than the Chicago Fair had, and less than the Baring failure in London; but there is no harm in setting it straight again. Legislation enacted in 1890 for the benefit of the silver mining interest, joined with the Dependent Pension bill and a large reduction of revenues by putting sugar on the free list that year, created grave uneasiness

abroad, and a resulting apprehension lest silver dollars might be forced upon creditors by the United States led to withdrawal of foreign capital from investments in this country. The return of our securities from Europe is plainly shown in the large trade balances of those years—our specie and merchandise going abroad to square the account. This movement would not alone have been sufficient to cause trouble on this side—for quite as much foreign capital has been withdrawn in the last two years as in 1891 and 1892 without hurting us in the least—if the distrust had not extended to our own people. First, credit was withheld by those who feared that what was advanced on a gold basis might be repaid in depreciated silver; then, by a natural perversion, credit was refused generally and all kinds of money hoarded; and the crisis was upon us. The banks and business houses that first fell were those most involved in speculations; real estate booms, mines and fancy stocks. Manufacturing works did not fail or lose credit until other concerns began to drag them down. These are the facts, as will be recalled by all whose memories run back six years. But it is so easy to beguile people who do not remember that it cannot surprise us to see interested men confidently maintaining that all that distress originated with the manufacturing industries and was due to the very moderate tariff reduction then contemplated and afterward made.

This alliance of tariff and trust ought now to be so plain that no intelligent man could hold a doubt on the subject. Yet people are perpetually trying to confuse it, and successfully confusing it for many minds, by suggesting that associations and combinations are not unknown in free trade England, and that many products not covered by an import duty (as petroleum) are subject to combinations here. This is a fog that can be blown away in a moment. We are not claiming that associations of producers are under all circumstances an evil, for we freely admit that they must continue to exist—that union for business purposes is something that has come to stay. The evil comes in when the association is encouraged to oppress fellow citizens by a monopoly which legislation has made and may unmake. Precisely the same or-

ganization may be a flagrant evil if granted a monopoly, and quite harmless if not so favored. Further, the monopoly that renders the trust formidable may arise from other sources—possession of land, deals with private corporations, and what not—as well as from legislation. But that does not prove in any way that we ought not to avoid using legislation to create monopolies. We see, too, why the trusts and combines are so much more harmless in England than here; legislation there does not put a weapon into their hands to aid in reducing citizens to submission. A recent editorial in The Iron Age suggests the danger of wage reductions as a result of tariff reduction, but its argument has exactly the same force against every possible cheapening of trust controlled articles. I must confess that these pretended objections appear to me almost too childish for discussion among candid reasoning men. I cannot believe that such men have a real doubt on the subject. If asked, Will you vote for the repeal of every duty which creates a monopoly, every duty which by cutting off importation from abroad cuts off all revenue from the government and at the same time enables the trusts to maintain prices against consumers in this country?—a negative answer can only come from an ally of those trusts. He who sincerely opposes them will unhesitatingly answer, Yes That is the test question.

There are good reasons for believing that if we only suppress the monopoly features of these combinations and prevent their doing so much of their work in secrecy, the community is not destined to suffer the injury from their machinations that so many timid people fear. I believe—this because I have faith that the universe is governed for good and that what ought to be will be; also because I have boundless faith in my country and her ability to come out right on all points in the end. There seems to be an inherent tendency to disruption in these organizations, explainable in several ways; divergence of views on the part of those participating, naturally arising, from the reluctance we all feel against surrendering the management of our affairs into the hands of others, outside rivalries which occasionally prove

too strong to overcome, business losses, whose effect is always to aggravate disagreements and strengthen rivalries.

TENDENCIES IN TRADE.

Even the shrewdest calculator may be deceived as to general tendencies in trade. It is somewhat surprising, for instance, that this enormous amount of gold mining and coining has not done more to raise prices. Even in this season of brisk demand and heavy export trade prices are, except in metals, still below the level of May, 1893. Even in their own affairs the best judges may be misled. I have seen many interesting examples of this in my 40 years' observation of the iron market. Men reputed able judges told us that the high prices early in 1873 were going higher yet with little prospect of ever coming down; and we all remember how the latter months of that year opened their eyes. Early in 1880 the same views were held, and one iron broker was so sure of an advance in February that he was quite willing to let me have a lot of pig iron, then selling at $36, for the price that would prevail four months later. The rate I paid was $22. There were in 1880 no business disasters to explain the reaction, such as those of 1873; and I earnestly hope we shall see none this year. It is the general impression among iron men that prices are going higher. Edward Atkinson, the great Boston statistician, thinks there will be a scarcity of iron for some time to come. I will quote from his last letter to me:

"Do you remember my prediction made ten years ago that the close of the century would find all existing furnaces incapable of supplying the demand for iron? Prices may be rushed to an extreme and react, but can be carried to no point that will prevent or seriously retard the accelerating demand for two or three years to come."

None the less, and despite my faith in Edward Atkinson and the favorable conditions for a rise, I do not look for a long continuance of even the present abnormal prices for iron and steel. I believe that the large foreign shipments now made are mainly to fill contracts dating from before the rise (coinciding, we must remember, with high prices and scarcity of iron in Europe), and

that fewer new contracts for delivery abroad are made at present rates. Also at home a check is noticeable in new undertakings requiring iron and steel. This indicates that the movement has reached an upper limit; and a reduced wheat crop this summer, which now seems only too probable, may make the reaction the more marked. Although the demand is likely to continue large and at good paying prices, the present condition of the iron trade is evidently too abnormal to last. But the sharpest business eye may sometimes be blind to the signs of the times.

Another ground for hope in the contest between any ring of capitalists and the whole country is based on the simple fact that capitalists soon die, while the country lives. Not often are the heirs in whose behalf the trust magnate labors, capable of carrying on his work. When he drops out, therefore, his capital and his skill usually go in different directions, and the people profit by the change. When the Rockefellers and the Havemeyers and the iron kings pass off the stage, will they leave successors as formidable? Furthermore, there is a disposition on the part of owners to popularize their stocks, of making friends and conciliating opponents, which helps to extend ownership over a wider circle. Associated with this is a movement which has already made some headway and is destined to make more—to admit employes to ownership. The trial of this plan made by the Illinois Central Railway is said to be very successful. The establishment of a common interest between workmen and capitalists may easily prove a shrewd policy in the part of that corporation —which has already suffered from a bad strike—and may thus set an example, which will be widely followed. This does not exhaust the field of possibilities, looking to natural remedies for the trust evil; it only tends to show that our case is not hopeless, if our legislative work against it is directed at the two vital points, monopoly and secrecy.

A SOUND CURRENCY.

A discussion of the combinations called trusts must needs show much that is vicious in them, yet it hardly seems fair to conclude it without calling attention to things that are more

vicious, more dangerous and more important to guard our country against. If our monetary perplexities are going to lead us into paying debts with false coin, or offering anything less than 100 cents on $1 in the recognized money of the world as an equivalent for what we have promised, then we are incurring a far worse peril than any to which the mightiest trust could subject us. Better submit to extortion, if we must, than to a general corruption. Better be wounded than introduce a poison into our blood; for a sound currency is the life blood of the body politic. Again, if the successful war we have just finished shall lead us to waste our strength, our substance and our national character in further military preparations; if the increase in our army and navy appropriations, from $40,000,000 to $240,000,000 in a single year, is something to be persevered in and not promptly reversed; if we are to make any more such bargains as that which brought us the Philippines, and with them a war on which we are spending, directly and indirectly, about as much every day as we have ever gained from their commerce in a year; then we must look on this awakening of the military fever among us, and not on the trusts, as our more dangerous enemy.

Only the blindest of enthusiasts or wildest of lunatics could overlook the crushing burdens under which the countries of Europe are now ground down by their military establishments, and rush headlong to thrust their own necks under the same yoke. A very few years ago both this country and Britain paid their way and steadily reduced their indebtedness; neither does so now. Our sinking fund is neglected, and our kin beyond the sea with ever increasing outlays are in no better case. All Continental nations are perpetually piling up heavier debts; Germany about $20,000,000 a year, Italy a little more, Austria Hungary more yet, and Russia still more—while for 20 years past the annual deficit of France has been about $100,000,000. Spain is bankrupt; Portugal, Greece and the South American republics are following the same sad example; and even Japan is signalizing her coveted admission to the roll of military States by accumulating a war debt. There is no relief in sight unless disarmament is possible.

At this very time across the Atlantic a handful of statesmen, assembled at the call of the mightiest of Europe's war potentates, are writing a new page in the world's history. That gathering, like ours here, seeks to benefit not only its own narrow circle, but all men for all time. In a strict business view the Congress at The Hague ranks as the most important move ever made; for no waste of power or treasure calls so loudly for remedy as that of war—no reform could be more vital than replacing general havoc and destruction by general exchange of benefits. Commerce is the great missionary of to-day, which, as Garfield told us, links all mankind in one common brotherhood of mutual dependence and interest." Give it the wealth now wasted on armaments, put universal arbitration in place of the brute's appeal to force, and the most perplexing economic problem of the time will be solved. That this solution is coming, every day's cable dispatches assure us. That our own loved country is taking an honorably prominent part in bringing it about, is most welcome intelligence to the true patriot. And the hope cannot fail us that the country will soon escape the dangers, not only of warlike entanglements, but of agitation for a clipped coinage and of oppression by the machinations of organized monopoly.

Some discussion ensued, in which most of the points made by Mr. Farquhar were upheld. The discussion turning upon the condition of the iron trade to-day and the production and consumption of raw materials. Thomas Devlin, of Thos. Devlin & Co., Philadelphia, made the following remarks: "It seems to me the conditions are entirely different to-day to what they were during the boom 20 years ago. Prices at that time were advancing owing to the extraordinary amount of speculation indulged in, a condition which I do not think exists to-day. Everybody able to buy nails, pig iron, or other staple products of iron in those days bought as heavily as he could, but I cannot see that any such buying is in evidence to-day. The demand now is a regular and legitimate demand, and consumers are buying their supplies upon the base of actual needs. In addition to that the country has a very large export trade which must enter into

the question largely." There was, he said, no possible danger of imports, but, under any circumstances, the country would be likely to continue to export. In his own particular line of trade, he said, export business was increasing, and prices were better, therefore under such conditions he could look for no immediate reaction.

Upon adjournment it was announced that the next meeting of the association would be held on Wednesday, September 6th, next.

PROCEEDINGS OF THE NATIONAL ASSOCIATION OF STOVE MANUFACTURERS.

At the Cincinnati Convention of this Association Mr. A. C. Mott, of the Abram Cox Stove Co., Philadelphia, read the following paper on "Molding Machines and the Stove Foundry:"

Your president has requested that I should read a paper on the subject of molding machines and their adaptability to the stove trade. Now, this can in no wise be called an address, but is simply a compilation of a few facts in regard to molding machines presented for your consideration.

In the first place, what are molding machines? This can be answered by saying that they can be classed under several different heads.

First. There is a molding machine which is known as the squeezer. After the operator has filled the flask with sand he presses the sand into position. This is generally done by a side lever, which is operated by the workman. All other operations in molding being performed in the same usual way as heretofore, therefore the name squeezer. It is simply the pressing or ramming of the sand into the mold.

Under the second head we might possibly class the machine as a draw or stripping plate machine, which by the movement of a lever drops the patterns from the mold, they being rammed in the usual way by hand. This machine accomplishes but one thing, which is the drawing of the patterns.

Under the third head we might class the machine as one which combines the squeezer and the draw plate, and the operation of this machine is to squeeze or ram the mold and draw the patterns. This ramming is done either by the operator using a lever, as in the squeezer, or by power.

Under the fourth head there is a machine which has recently been placed upon the market, and is known as the vibrator. This is usually combined with power for ramming (said power being used in the form of compressed air), thus almost instantaneously ramming the mold. The patterns are withdrawn by the move-

ment of a lever with the right hand, and at the same time the operator presses a compression cock with the left hand, bringing a small hammer into play, which vibrates the pattern as it is drawn from the mold, and the operation is as follows: The ramming head is thrown back, leaving the top of the machine clear, a flask is placed on the same and filled with sand, a three-way cock attached to the machine is quickly operated, admitting compressed air of 70 to 80 pounds pressure to the inverted cylinder, the head having first been drawn into place. The cylinder, with the entire upper portion of the machine, is thus driven forcibly up against the ramming head, flask, sand and all. Often a single blow suffices to ram the mold often the blow is quickly repeated (according to the demands of the particular mold in hand). Gravity returns the machine to its original position, as the three-way cock opens the exhaust. After pushing the ramming head back and cutting sprue, if the half mold is a cope, the operator seizes the lever, and drawing it forward and down raises the outer frame of the top of the machine containing the flask pins, with flask and sand thereon, away from the patterns, thus drawing the patterns from the sand. The operation on the drag is the same, but (as you will readily perceive) you must have two machines and a pattern for both cope and drag. Just as he seizes the pattern drawing lever with his right hand he presses with his left on the head of a compression valve, thus admitting air to the pneumatic vibrator already referred to. This consists simply of a double acting elongated piston having a stroke of about 5-16 inch in a valveless cylinder, and impacting upon hardened anvils at either end at the estimated rate of 5,000 blows per minute, like the well known chipping or calking hammer. This vibrator does not really rap the patterns; it simply puts them in a condition of shiver, relieving all tendency of the sand to adhere to the patterns, thus allowing intricate carving in the center of the mold to be drawn as readily as the outside portion.

Having thus briefly described the different forms of molding machines, we have to consider their advisability as to stove plate molding.

In the first place, the majority of these machines are intended for snap work, or molds which are usually made in snap flasks, and for these, where there is great enough multiplication, there is no doubt as regards to the utility and usefulness of either of them; but stove plate molding presents difficulties in the way of their general usefulness. The great majority are made in iron or wooden flasks, specially formed and barred for the patterns which they are designed to mold, and these are made in very small quantities. None of the machines that ram the mold (either by leverage or power) are designed to ram a barred flask. There are, however, certain articles (very few in number), namely, legs, covers, cross pieces and certain grates which may be made to advantage on these machines; but (as you will readily see) by taking either of these forms of machines, the draw plate (for instance) requires such an expense to make it and such care taken of it afterward that, unless there could be made at least 60 full days' work throughout the year from one pattern, the saving would hardly pay for the expense of the draw plate.

As in all of the articles mentioned or any others which I know of (in stove plate molding) it would require a pattern and a draw plate, both for the cope and the drag of the mold, and the usual operation would be that one operator would make the drag on one machine and another operator would make the cope on the other machine, placing the two together on the floor.

In the making of these draw plates the utmost care must be exercised; in fact, the operation is so delicate that it requires a mechanic capable of working to 1-64 inch or less to make these plates properly, which of itself is very expensive.

On the vibrator machine the same difficulties occur.

In using this machine a match plate for the cope and drag have to be made, and these would have to be machined to a surface and the patterns placed thereon. This could not be made in the form of an ordinary match plate (such as we are familiar with in the stove trade), but would have to be started from a level plate and planed to absolute thicknesses, and then the drag or cope pattern placed on and fastened to this plate with the neces-

sary partings. The same operation would have to be gone through with both cope and drag, and all parts brought into perfect alignment; therefore, I would repeat that there is no form of machine, to our knowledge, in which the expense of rigging up for the machine would not be so great that, unless there were at least 60 full consecutive days' work for the machine on one pattern, it would not be of any economic value whatsoever.

It is claimed (and is possibly true) that some of the large pieces of stoves made in bound flasks could also be made or used on the molding machine, but this would mean a large quantity of special flasks. To illustrate: If a molding machine be made capable of making 60 top flasks per day, there would have to be 60 special top flasks provided for this work, and these flasks, when not in use (as well as the patterns), would have to be cared for and stored, and as the average number of tops (in the average sized stove foundry) of any one size and style does not exceed 600, this would leave but ten days' work for the machine, and the storage and care of 60 flasks and the match or stripping plates during the year.

Now, while these machines are highly recommended and are adaptable for such articles as pipe fittings, car castings of different styles, hardware where large quantities can be made, yet everything depends upon the quantity.

We know of one shop where molding machines are used and where the minimum order given for castings from the machine was 5,000 molds, and in this shop their casting room for the storage of these castings occupies more space than the storage for their finished product. In fact, if my memory serves me right, they use a warehouse ground floor 300x800 feet.

We have had our attention called to an agricultural shop, in which we have been credibly informed there are 200 mowing machines made per day, all of one pattern. In this shop they use molding machines and use them to great advantage as well as economy, as the men work on one pattern day in, week in and month in from one year's end to the other, on the same identical pattern; and as some of these patterns are duplicated, taking two

to a machine, they make as high as 400 castings from one pattern per day. These people use simply a stripping plate machine, as their flasks are barred and rammed by hand. They usually work their men in gangs, one gang making as high as 200 molds in one day

The daily melt in this foundry is from 150 to 200 tons of iron, and yet we venture to make the assertion that there are more separate patterns in one line of ranges (comprising two sizes) than they have in this entire shop, and they claim their fittings for draw plate molding alone have cost them upward of $50,000.

There are, no doubt, advanced men in the stove trade who believe that they can utilize these machines in their shops, and there may be special features, peculiar to themselves and their work, which will enable them to do so; but we cannot but think that in the majority of instances it will mean time, brains and money expended without adequate results.

In conclusion, would say that the time may come (but it now seems very far distant) when molding machines can be used to advantage in stove plate molding, but that time can only come when such a consolidation of interest is made as will bring the 100 sets of patterns of one type of range now made down to one universal type made in one foundry and under one management. When this millenium arrives, then molding machines will be a feature of stove plate molding.

A REVIEW OF THE FOUNDRY LITERATURE OF THE MONTH.

IRON AGE.

Commenting upon the paper read by Mr. A. B. Farquhar before the Philadelphia Foundrymen's Association, and published in this issue of the *Journal,* the *Iron Age* of June 15 says editorially.

"We may confess frankly that we object most strenuously to having the name of "Trust" with its flavor of odium applied to the recent consolidations, so far at least as those are concerned which are connected with the iron trade. The only justification for the title, in the case of a few of them, is the superabundance of "trust" which is placed in the boards of directors or executive committees. Their powers are so unlimited that they are a serious temptation to honest men, and may easily become a dangerous tool in the hands of tricky speculators. The investing public will soon learn to discriminate against these, and their securities will clearly express in figures the doubts as to the wisdom of such charters.

"We must express our surprise that Mr. Farquhar falls into the error of so many reckless newspaper writers and so many scheming demagogues when he refers to the enormous capitalization of the "trusts." The nominal capital of modern consolidations has no more to do with their position than has that of the $10,000,000 gold mining company whose $10 shares are selling at extravagant prices when quoted at a penny a share. He refers to the familiar statement that in one month companies with a capital of $1,000,000,000 were organized in New Jersey. Now, it is a fact that practically one-half of the sum is nominal capital only, since one share of common stock in nearly every case went with one share of preferred stock. But this is really a minor matter. The point to be considered is the earning capacity of the properties. If they have loaded themselves down with excessive amounts of cumulative preferred stock their common stocks are practically worthless, and their inability to keep up the

dividends on the preferred will force the value of the latter down to its true figure.

"At the bottom of the fear of a large capitalization lies the unwarrantable idea that the country owes these consolidations a return on their self-made estimate of its value. That fear might be justified if the consolidations possessed a natural or an artificial monopoly, which really none of them do.

"It is natural that they should be striving for the one or the other. In the iron trade nearly every one of them is endeavoring to fortify its position by going back to supplies of cheap ore and fuel. In the case of ore, this is precarious, to say the least, from a monopolist's point of view, because no man can tell what reserves are hidden in the woods and tamarack swamps of Lake Superior. So far as fuel is concerned, there is even less cause for anxiety on the part of the public. A monopoly is impossible in that case, and any attempt to extort unduly high prices will make available supplies—possibly not as good nor as cheap—but certainly adequate to permit of profitable utilization at an artificial range of values for product.

"Natural monopolies in the iron trade can exist only if handled with the greatest moderation. Artificial monopolies, through the control of plant, are even more shadowy as a menace to the public. In the staple lines in the iron trade there is not one branch which is controlled by patent ownership. The establishment of works is simply a question of money, and their successful operation merely a matter of securing technical and commercial skill. The managers of any consolidation who ignore these patent facts and who wield oppressively what power they possess are simply wrecking the property in their charge.

"It so happens that the consolidations in the iron trade were formed at the time when natural conditions favored a tremendous rise in prices. That rise has taken place in all branches of the trade, whether they be under partial control of the new organizations or whether they be absolutely free from them. In fact, the advance has been greater in some lines of products with which consolidations have absolutely nothing to do.

"We are willing to admit that the prevailing circumstances have given the consolidations extraordinary opportunities, which they are now utilizing in the right manner by strengthening their position. Nearly every one of them has been forced to pay high prices for rattle traps which will soon wander into the scrap heap, when the present pressure for product is over. Nearly every one of them is using its large working capital—by the way, another important acquisition through consolidation financiering—for modernizing and improving plants. They must do this in self-defense, because antiquated plants would be a fearful element of weakness in the future competition with newcomers starting with an entirely new plant.

"It is needless to say that the improvements thus being made will enormously strengthen the American iron trade when the real battle for the supremacy in the world's market comes—the campaign of 1897 and 1898 really having been little more than a reconnoissance in force.

"Those managing the majority of the consolidations in the iron trade realize that economy in production and in distribution are the principal aims for which they must strive. They are acting also, we are glad to say, upon the conviction that economy and regularity of production depend to a great extent upon gathering a picked, efficient class of workmen, and that they are doing by paying high wages. There is no better way to crowd down labor cost."

AMERICAN MACHINIST.

In the issue of June 1st, Ezra Estep, of Sandwich, Ill., writes as follows of "Cast Iron Dies:"

We have made many dies of cast iron for bending and forging wrought iron and steel, and where the corners are not required to be too sharp have had very good results. We cast the dies for drop hammer or press with the tongues solid, so that all is in one piece. The part I wish to call particular attention to, however, is that we are using a very hard iron for grinder burrs and work of that kind, and when we want a die to last we cast it in the hard metal, but to do so we must have the

pattern correct to size and smooth, as no filing can be done on this hard iron. These dies last to do an immense amount of hard forging and bending.

We have one bending form for a steel crank of 1-inch round steel with sixteen bends. The form is part cast and part steel. The steel corners always give out first. The hard metal lasts much longer and gives better results, as the hot steel does not soften it; but the steel pieces on the form soon get so soft that they bruise easily and get out of shape, so they have to be renewed often.

In the issue of June 8, R. H. Palmer describes in detail the molding of a Drop Press Bed.

In the issue of June 22 the following answer is given to a question asking for a formula for cement to fasten wood to cast iron for use in pattern work:

"A cement recommended for fastening wood to iron is made by dissolving glue in boiling water, making it of the consistence of cabinet-maker's glue, and then, while stirring, add a sufficient quantity of wood ashes to produce a mixture resembling varnish. The surfaces to be united are heated and covered with this cement and allowed to cool. We doubt, however, if this cement will prove entirely satisfactory for pattern work unless it is supplemented by some form of fastening, such as screws or dowel-pins."

R. H. Palmer describes the molding of a Corliss Engine Pillow Block in this journal of June 29.

IRON TRADE REVIEW.

We quote the following from the issue of June 1, where, under the caption "Technical Men and Shop Men" this journal says:

There have been two classes of contributors to foundry association literature—those who as engineers, metallurgists and chemists have had to do with foundry operations because of a preliminary training in technical institutions and a later experience in the practice of works, in which they have had opportunity to apply what the schools gave them; and, on the other hand, those whose acquaintance with foundry practice has come almost

entirely from experience as workmen on the molding floor, at the cupola, and at length in the supervision of operations, through promotion from the ranks. Each of these classes has made notable contributions to the proceedings of the associations. That each has not always fully appreciated the other has been in evidence now and then. Those who sat in the Franklin Institute at Philadelphia and heard the discussion at the second day's meeting of the National convention of 1896 will well remember the onslaught of the foundry floor upon the so-called theory of the technical corps. The discussion ranged over a vast expanse of physics and chemistry, bad iron and bad castings, test bars large and small and round and square. Graduates of the molding floor seemed almost disposed to maintain that cast iron operations were presided over by a fickle genius who took delight in thwarting the cleverest plans for the making of sound castings; while the technical gentlemen present, with well assumed patience endeavored to indicate how many uncertainties would disappear before an intelligent application of science to the making of mixtures, the melting of the metal and its later manipulation. Probably that discussion, with its multiplied crudities, was one of the most valuable of all, in that it showed the lines on which the campaign of education must proceed, and the deep-rooted difficulties it must encounter.

It must be said that one result of the mingling of foundry floor men and technical men in the various associations has been to beget a more wholesome respect in each for the other. Community of interest has been established. But there is much to be done to bring the two elements to occupy common ground. On the technical side not a little of the progress that has been made in the study of cast iron in the United States has been due to the willingness of the so-called rule-of-thumb element in the foundry associations to adopt advanced methods so far as they are demonstrated to have a practical outcome. It is admitted on the other side of the water that more attention has been paid to cast iron in the United States than in Europe. Yet investigators here know that only a good beginning has been made. And this ex-

plains the slowness of many practical foundrymen to take an advance step. Some of them make the point that the technical men should be better agreed before they ask the foundry world to abandon what it so long has leaned upon. They have been told that silicon is the key to the regulation of foundry mixtures. Yet in one of the latest papers on cast iron, that of Bertrand S. Summers before the Iron and Steel Institute, the author emphasizes the position taken in his Buffalo paper before the American Institute of Mining Engineers, that carbon, rather than silicon, is to be the controlling element in planning foundry mixtures, as so much depends upon the state in which the carbon exists. Silicon, he grants, has an effect on the state of the carbon, by retaining it in the graphitic form, but its action is dependent upon the temperature. The preponderance of graphitic temper carbon, he holds, explains the strength of certain so-called semi-steels and other forms of cast iron.

We do not justify the criticism of the old-school foundrymen. It is no more reasonable than to ask rival schools of medicine to agree before either essays to treat a patient. We refer to it simply as a sentiment that exists; and its existence is not altogether an evil, since it will modify and give practical direction to the work on technical lines.

In the issue of June 29, Dr. Richard Moldenke has prepared a condensed translation of Prof. Ledebur's article on "Latter Day Foundry Progress," which originally appeared in *Zeitschrift des Vereins Deutscher Ingenieure.* He says:

We are witnessing the close of the 19th century, and as thinking men look backward and weigh the good and evil it has brought us, changes of far-reaching consequence in our political and social life, in science and industry, and taken all in all, we find that in the latter respect we have done more in this than in the five centuries preceding it. At the close of the 18th century the steam engine had come to assist labor and made us independent of water power, then essential to heavy production, and the forces of nature were thus harnessed for the service of mankind in a greater measure than ever. The more, however, that steam

was employed the greater did industrial activity extend, and so with the transportation facilities which came with the railroad, an undreamt of exchange of raw and finished products took place which we to-day are doing our best to still extend.

Even in the foundry, which had developed steadily since the 14th century, this influence was noticeable at the close of the 18th. At that time foundries were adjuncts to the blast furnaces, castings being made of direct metal; in fact, we might say the blast furnace was the adjunct to the foundry, for only in sections remote from furnaces did a founder travel about with a portable melting outfit and pig iron to cast the local work, which usually consisted of kettles, stove fronts, weights, etc. Even where a machine shop was started, the blast furnace and foundry formed the principal item of the plant. It was soon, however, found that the connection of furnace with foundry was rather detrimental to the proper development of the latter, and the iron made on Sunday and scrap products were melted in a separate furnace for casting instead of going to the puddling furnace. There was, moreover, a greater quantity of fluid iron available at one time for the production of heavy castings, and the increased expense of this method was more than counterbalanced by the advantages derived. One was no longer dependent upon the current output of the furnace, but could vary quantity and quality in making castings at will. Further considerations, not necessary to enumerate at length, have gradually separated the blast furnace from the foundry to such an extent that in 1897 but 2.8 per cent of the castings made in Germany were of direct metal, while in 1871 the percentage was 17.2. The production of castings has steadily risen in recent years. In 1871 Germany produced 418,000 tons; in 1887, 795,000, and in 1897, 1,500,000.

The invention of the process of steel casting in 1851, which was expected to injure the foundry trade materially, did not do so, notwithstanding the fact that the casting of steel has assumed enormous proportions. The great demands upon the productive capacity of our foundries will naturally lead to the ultimate perfection of the foundry appliances just now coming into use.

Manual labor was the rule in the early years. The introduction of machinery has lowered costs; melting furnaces were improved greatly so that more metal could be melted in them, and this with a smaller expenditure for fuel. Science gave us the means of properly mixing and melting the iron. Even the construction and arrangement of the modern plant is based upon different principles than was formerly the case. Such has been the effect of a forced increase in production.

The views about pig iron current 30 years ago seem strange to us to-day. We all know that white irons were not good for ordinary castings and that the carbon therein was combined, while it was graphite in the gray varieties. The grayer and more coarsely crystalline a pig iron was the higher the price paid for it, and so it came that blast furnace managers, in making a cast, would often run slag over the pigs to keep them hot as long as possible, thus promoting the formation of very large crystals. When this iron was remelted and the nice large crystals disappeared in the castings the reason why was looked for in vain. It took some time before there dawned upon the minds of foundrymen that a third body, silicon, affected the other two, carbon and iron, to such an extent that a repeated melting of the same iron, by burning out the silicon, could lead to serious difficulties, and that, therefore, the higher silicon gray irons were the more valuable. Blast furnace managers are now pretty familiar with the effect of silicon upon iron, and in some American blast furnaces foundry irons are now cast in chills and sold without regard to fracture appearance. In spite of our knowledge of the uncertainty of fracture indications, pig iron is still graded and sold in this way, and many are the mistakes resulting therefrom. The silicon contents of a casting should be a function of its general dimensions. The heavier the casting the slower it cools, and therefore the lower its silicon contents should be. Hammer dies require little over .5 per cent, water pipe, machinery castings 1.5 per cent, and art castings, stoves, etc., over 2 per cent. In making up the cupola charge due allowance must be made for the loss of silicon in burning out. This amounts to .10 per cent on an average.

Manganese, if it was considered at all, was usually held to be a desirable element. It was supposed to strengthen the casting. Whatever this benefit may amount to, its injurious effects are certainly very marked also. Manganese whitens the iron, increases its shrinkage and contraction, aggravates the internal strains, and in general is not desirable in quantities over 1 per cent, especially where the castings are thin, have to be machined, or are subject to shock. Water pipe should, therefore, not run above 1 per cent in manganese. In the cupola, however, manganese is a valuable constituent; it protects the silicon, and hence a high maganese iron can be remelted oftener than one low in this element. This would indicate that the manganese of a pig iron should not run over 1.5 per cent. Phosphorous was long known to be deleterious when present in large quantities, nevertheless, many of the ills ascribed to it are traceable to other causes. It promotes brittleness and liability of breakage under moderate shocks. Its influence is more marked with high manganese and reduced with high silicon. A 1.4 per cent phosphorous iron low in manganese and with plenty of silicon may still be serviceable for castings not subject to severe shocks. Where there is danger to human life as the result of breaking castings, 0.5 per cent phosphorous should never be exceeded.

The question of sulphur is not usually a serious one, as the percentage seldom runs above 1 per cent in the ordinary foundry irons. However, if the coke used is rich in sulphur, or an insufficient amount of limestone has been charged for slagging off, the thinner portions of a casting will soon show this. If in charging the coke bed limestone is not added, the first iron trickling through it will be much richer in sulphur than would have been the case if the basic slag had protected it.

A review of the pig iron situation of the continent is interesting and shows that Germany, while formerly dependent upon Scotch and other pig irons for foundry purposes, and still importing over 300,000 tons annually, has succeeded, after a careful survey of its own iron resources, in reducing the ratio of foreign to domestic iron from 4 to 1 down to 1.3 to 1.

The question of proper testing methods to determine the value of pig and cast iron has received considerable attention. First of all a chemical analysis will give reliable indications of the value of a new brand of pig iron. This analysis should be very thorough, as the presence of some of the rarer constituents may mean mischief. Thus the presence of .1 per cent of chromium means a brittle casting. Physical tests of cast iron are very important, and are now universally performed. Attention is called to the fact that a machined bar is stronger than a rough one, and that continued rattling of bars in the cleaning process also removes weakening strains. Finally the effect of the size and shape of a bar is a very important item, all indications pointing to the desirability of having the bar, and the casting it is to represent, as like in section as possible.

In the preparation of pig iron for the cupola, the breaking of pigs into small pieces is now accomplished by mechanical means in many places. A small hydraulic press suitably mounted will allow two men to make 10 to 12 fractures a minute. Where the pig is high in phosphorous, and hence breaks easily, the old way is naturally still preferred.

For melting the pig iron and scrap, the cupola is the rule, the reverbatory furnace the exception, the crucible now being very rare. Only in the making of rolls or very large castings is the reverbatory furnace in one of its modifications used, otherwise the cupola will be found the most convenient. This has been greatly improved in this century. At first the cupola was intended to supplant the blast furnace and was run like it, a single tuyere usually serving to allow the entrance of the blast and a blue flame of burning carbonic oxide from the stack showing the nature of the process. Gradually it dawned upon the ironmasters that the process of reducing ore in the upper part of the furnace to iron and then melting it down below was different from the mere melting of pig iron, and hence the cupola process was gradually changed to what it is at present, for as complete a combustion as may be to utilize all the heat of the fuel for melting only, is desired, no chemical action being necessary. This meant

the cutting down of the fuel to one-half. On the other hand, the liability to oxidation, the burning out of the silicon and loss in iron was increased, but the net saving was nevertheless very great. So far as the cupola itself is concerned, aside from what the makers of the various kinds claim for them, it is practically only a matter of the tuyere arrangement. Whether this be one row of good wide openings, or two of them with varying distances between, they all, when the cupola is very large, have to contend with the difficulty that the blast does not reach the center readily. The arrangement of Mr. West, however, which provides for a center blast, overcomes this drawback and should be very valuable for cupolas of large diameter. The use of the steam jet to draw air into the cupola, as exemplified in the Herberz cupola, while very ingenious, is not economical, less steam being used to drive a fan than to draw the same air direct.

The blast for a cupola was formerly obtained from blowing engines, the regular blast furnace apparatus being adapted to supply the cupola also. The excessive pressure was soon found, however, to be a detriment, and cheaper and better means were provided. The reaction in favor of fans, which took place in the early decades of this century, was gradually modified in the sixties, and the modern pressure blower now divides the field with the fan in the foundry industry.

The use of green sand in the foundry was introduced by Abraham Darby in the early part of the 18th century, and has since then made great advances in usefulness. Where formerly loam was required, as in the case of work molded up by sweeps, for the last 20 years green sand has been used successfully. Special care in the selection and mixing of the molding and facing sands will amply repay itself, and during the last 50 years much of the hand work done in this line was performed by machinery. Centrifugal mixers are invaluable for breaking up and thoroughly mixing the sand, their especial value being in evidence when mixing up facing. This mixture of sea coal and sand (in which the burning of the coal prevents the sand from adhering to the casting) is all the more effective the more intimate the mixture of coal

and sand can be made. Hence the advantage of machine mixing over hand. The sifting and conveying of sand mechanically may also be mentioned here.

The most pronounced improvement in foundry appliances is the molding machine. Not only has the cost of molding been reduced considerably, but the castings are truer to the pattern and more uniform in weight. There are two main classes of molding machines: those which use the portion of a pattern to make a whole mold, such as in making gear wheels by machine, and those which withdraw the whole pattern from the mold after it is rammed up. In the latter case the molding machine may be a mere sand ramming device, or it may have a draw plate and be quite elaborate. Match plates were used as early as 1827, and primitive molding machines are now 40 or 50 years old. The use of hydraulic power dates back to 1890, and at the present day this, compressed air, and steam are used extensively.

Dry sand appliances are comparatively unimproved; the same methods of drying molds, which were in use early in the century, may be still seen to-day. After all the main object is to bring dry, warm gases in contact with the molds, so that the moisture is driven out and removed. For this reason if gas firing is used and products of combustion should not touch the molds, an effective system of ventilation must be provided to take away the steam. In some instances skin drying is sufficient, but there is danger, if the molds stand too long, that the moisture of the body gets to the dried surface again.

The cleaning of castings has been greatly improved. From the old scratch brush and file it went to the revolving brush and grindstone, then came the tumbling-barrels, and finally the sand-blast. Pneumatic chipping tools now take the place of the tedious hard work, and one man thus provided can do the work of four.

Foundry buildings and their equipment have changed wonderfully. The two questions studied to-day are cranes and light. Wooden jib cranes run by hand have been replaced by traveling cranes of many types. An abundance of light is now the rule

rather than the exception, even skylights being provided. The use of the traveling crane has evolved a new type of foundry building—an extended main section of the width of the crane, and side wings or "lean-tos" low enough to give a series of windows above them to flood the central portion with an abundance of light and air.

THE FOUNDRY.

Eli H. Pearce tells of some points connected with every-day cupola practice. He says in part:

"Many a good molder knows very little about melting iron, and it frequently happens that just such a man is called upon to run one of these little foundries, and such was the case at a shop that I visited recently.

"When he tapped out, the stream of iron fairly shot from the tap-hole, and such was the shape of the "breast" that it was impossible to stop up while the iron was running, and so, all in excess of enough to fill the ladle was permitted to run over onto the floor!

"I observed that the tap-hole was of even diameter flush to the front, and I suggested to the molder that if he would make it funnel-shaped next time he would be able to make the stopping bods stay in place.

"Upon my asking why the iron came out with such force, he replied that it melted fast. I happened to be there when he was making the bottom of the cupola for the next heat, and found that he made the sand bottom 8 inches deep at the back and 4 inches at the front, which gave a fall of 4″ in 20″, the latter being the inside diameter of cupola, which, of course, sufficiently accounted for his difficulty. I thereupon asked him to let me shape the bottom for him, and he freely consenting, I reduced the height at the back to about 4½″, which gave a gentle slope, with the result that no difficulty was experienced in taking care of the iron or in stopping up when the ladle was filled."

In "Cast Iron Notes" Mr. Keep deals with "The Fracture of Pig Iron and Its Physical Character," of which he writes as follows:

"One of the most interesting and useful exhibits at the convention of the American Foundrymen's Association was samples of pig iron made in the iron molds of the modern casting machine.

"By casting pigs in iron molds and treating all pigs alike the fracture shows exactly what kind of castings the pig iron will make.

"With the casting machine the iron is first caught in large ladles and is then poured into a series of iron pig molds that pass under the stream of molten iron. The hot pigs pass through water and are dumped into cars for shipment. The only variables are the condition of the furnace, the temperature when the iron left the furnace, and the chemical composition, but the whole of the iron is collected and held in a ladle until it is of uniform composition, and the pig molds are filled and cooled so rapidly that any chilling tendency is at once apparent in the fracture of the pig. The fracture of sandless pigs is, therefore, a perfect indication of the kind of castings that they will make. If a non-chilling iron is poured into an iron mold the fracture against the chill will be darker and closer than at the center of the pig. Then conversely, if a pig that was cast in an iron mold shows a darker fracture at the chilled surface it will make a soft casting without any chill. If such pig iron shows a slight chill around the sides of the pig, if remelted and cast in a sand mold it will make large castings, without chill, but is not fit for small castings, as they would be white.

"If we postpone the discussion of chemical analysis in the foundry a little while until the furnacemen generally adopt casting machines for pig iron, we shall find that the fracture of the pig made by the machines will show exactly what kind of castings can be made from them. Then there will be no chance for the fracture to be deceptive.

"There will be no necessity for the founder to have a chemical analysis, because he can see the character of the iron that he buys.

"The physical properties of cast iron do not correspond to the chemical analysis, and they will not correspond when all pigs are cast in iron molds, but the fracture will then show exactly what kind of a casting can be made from the pig iron.

"That is mechanical analysis; the quality of the metal can be seen by the eye.

"The best mechanical analysis is the measure of shrinkage, which shows the influence of the silicon contained in the iron, along with all the other elements, and in the presence of all conditions which influence the physical quality.

"With the fracture of sandless pigs, and with the measure of shrinkage, we shall have a guarantee of the castings that can be produced, and we will know that the iron can be softened by increasing silicon.

"This can be done by a founder who has not had the advantage of an education in a school. Many founders are of this kind, and it is very gratifying that they will not need to suffer on this account. Another favorable feature is that the founder needs no help, and can get the necessary information quickly and with no expense, and the information will be positively reliable.

"At the meeting of the foundrymen's association a paper was read and two pigs of iron and test bars from each were shown to prove that the appearance of the fracture of the pig would lead the founder to select the wrong iron, and it was stated that the chemical analysis of the two pigs showed what the physical quality of each would be.

"The author gave the following data. The open grained metal in a test bar one inch thick showed a shrinkage per foot of .150, and half inch thick .220, and the silicon was 1.15 per cent and sulphur 0.07. The fracture was open, bright and rather light colored. The close-grained metal in a test bar one inch thick showed a shrinkage of .092 and half inch thick .137, and the silicon was 2.67 per cent, and sulphur 0.06. The fracture was dark and very close.

"The measure of shrinkage of these two irons is a mechanical analysis, showing that the open-grained iron does not con-

tain enough silicon for castings as thin as half an inch, but that it would make excellent castings more than one inch thick.

The mechanical analysis shows that the close-grained iron will make the thinnest castings, and the fracture of the pig shows that on account of its exceedingly close grain it will make a close-grained and therefore a strong casting one inch thick.

"The records of the test bars are as follows, and all bars are one and one-half inches wide:

Thickness.	Shrinkage.		Measured strength.		Strength reduced to 1 inch thick.	
	Open.	Close.	Open.	Close.	Open.	Close.
$\frac{1}{8}$	.293	.178	110	164	7040	10496
$\frac{1}{4}$	.266	.163	320	344	5120	5504
$\frac{3}{8}$	.242	.150	550	530	3982	3768
$\frac{1}{2}$	.220	.137	860	920	2150	2300
$\frac{5}{8}$	.200	.125	1280	1208	3277	3092
$\frac{3}{4}$	.182	.112	1600	1640	2844	2915
$\frac{7}{8}$	.165	.101	2240	2320	2925	3032
1	.150	.092	2900	2860	2900	2860
$1\frac{1}{4}$	.148	.088	3640	3500	2329	2240

All tests of bars of cast iron of varying size cast from the same iron show that the thinnest castings are strongest and that the thickest castings are weakest, because rapid cooling makes a close, compact grain and strong casting. Therefore, pigs cast in iron molds will have close, compact grain and will make close-grained, strong castings.

"It is seen that the chemical analysis (silicon 1.15 and 2.67) gave no indication whatever of the strength of the castings, but it would tell one familiar with chemical analysis that their castings with 1.15 silicon would be white and with 2.67 silicon would be gray. But mechanical analysis (shrinkage .220 and .137) told the same thing much quicker and with less expense, and anyone could do it.

"The dark, close-grained fracture of the close pig would tell an experienced founder that it would produce a close-grained, strong casting. The chemical analysis of the two pigs did not indicate the physical character for, excepting the very thin castings, the strength of each corresponding size of test bar is practically the same."

THE TRADESMAN.

Writing of "Whirl Gates," Mr. E. H. Putnam says, in the issue of June 1st:

"A writer in one of our exchanges, telling of his experience in casting pistons, says that he 'set the gates so as to cause the iron to whirl in the mold, thus crowding the dirt to the center, leaving a sound outer shell.' These pistons had large cores in them, occupying the greater part of the mold cavity. He says, further, that they 'always poured the iron as hot as possible, believing that by this method a sounder casting would result.'

"The hot iron was what gave clean castings in this case, while the whirlgate had absolutely nothing to do with it. In order to make a whirl gate effective, the whole mass of iron in the mold must be caused to flow round and round with sufficient rapidity to set up a considerable centrifugal force (that is, where the whirling of the iron is to be produced in the mold cavity instead of in the gate), and it is plain that no such movement could be produced in a large mold whose space is principally occupied by cores. The philosophy of the phenomenon is this: When molten iron is caused to whirl rapidly in the mold, the iron being heavier than anything that may be floating in it, is thrown with the greater force to the parts farthest from the center, toward which the lighter substances are crowded."

"In a mold of sufficient dimensions, this whirling motion may be produced, provided there are no cores or other obstacles sufficient to impede, but not otherwise. So that whatever skimming is done in the case of a cored piston must take place somewhere outside of the mold proper. A whirl gate may be used with good results. In this case the whirling movement is produced in a

specially constructed gate, situated somewhere between the pouring gate and the mold cavity.

"It was the hot iron that gave this man his clean castings. Hot iron is not really any cleaner than dull iron, but paradoxical as it may seem, it will make a much cleaner casting. In very hot iron the dirt is finely disintegrated, and is distributed evenly throughout the mass, and if the mold is filled with iron in this condition, the dirt particles simply rise toward the upper surface, many of them stopping before they reach that point, and the fine particles of dirt that may arise through the emollescent sand-chilled upper surface will hardly disfigure the casting, and will seldom do any material damage. Furthermore, the impurities in very hot iron are in a molten state, and it is probable that a considerable portion of these do not become segregated out from the iron in the cooling process, so far as to be apparent to the eye. But it is very different in the case of dull iron. That iron melts at a lower temperature than some of the impurities contained in it is evident from the fact that the latter float upon the surface of dull iron, in a solid state. When this iron is poured into a mold, carrying more or less of the dirt with it, the latter will float on the surface, ready to cling to any angle in the mold, being held by the iron that chills and becomes solidified wherever it comes in contact with the sand.

"Thus it appears that, though hot iron and dull iron may each contain an equal amount of dirt, the former will make a cleaner looking, and a better casting than the latter.

"As we have said before in this department, it is always best to pour iron as hot as the mold will bear. Some molding sands will not bear very hot iron, while other sands will produce a good surface on the casting no matter how hot the iron may be when poured, except, of course, in a very heavy class of work. In the latter case, treating with molasses water and black-wash, and then skin-drying, will be helpful. But in cases where this is not enough, either dry sand or loam is required; and in all cases, if you would attain the best results, pour the iron hot."

In the issue of June 15, referring to the controversy existing as to whether chemical analysis is of the greatest utility, the same writer says:

"There is one particular feature of this discussion that I think entirely wrong, and which has been, unfortunately, too prominent at times, viz: the attempt to set the chemist above the practical foundryman in the management of the foundry. There can be no valid objection to the exaltation of intelligence and education above stupidity and ignorance; but this is not properly a part of the question. As between the chemist and the foundryman, which is best fitted to conduct the foundry? A man with just a little bit of common sense will, of course, choose the latter. The trouble is that when the question arises, some men picture the chemist as an educated man, and the foundry foreman as an ignoramus. But what is education? If an intelligent man spend a year in learning to analyze coke and iron and in studying the effects of combination in various proportions of their different constituent elements, or of the foreign elements contained in them, he will have acquired a good education in practical foundry chemistry. Let the same individual give his best energies for the same space of time to the acquirement of knowledge of practical founding and he will not have learned the A B C thereof!"

MECHANICAL WORLD.

The Mechanical World of June 2 has an illustrated article on the molding of Corliss cylinders, by Joseph Horner.